

MECH 472: Thermal Systems Design

Fall 2017 Syllabus (Subject to Change)

- Instructor:** Laura Schaefer, MEB 106, x3836, las14@rice.edu
- Class Hours:** TR, 8-9:15 am, DCH 1064 (3 credits), with meetings in Duncan Symonds II on 9/12, 9/14, 10/24, 10/26, 11/16 (computer lab times may shift during the semester; this will be updated on the course web page)
- Office Hours:** TR, 2-3 pm, and by appointment (subject to adjustment after beginning of semester)
- TAs/Graders:** Kenechi Agbim, Marcelo Fernandes, Danielle Perdue, MEB 112, Office hours TBA
- Objectives:** This course will provide students with the tools to analyze and design energy systems.
- Outcomes:** At the conclusion of this course, students should be able to integrate material from the basic courses in thermodynamics, fluid mechanics, and heat transfer into the design of various thermal systems; gain experience in using computer techniques in modeling and simulating typical thermal systems; perform economic calculations involving time and interest; and be familiar with the environmental impact of energy systems.
- Textbook:** There is NO required textbook. One **recommended** textbook is Design of Fluid Thermal Systems, 4th ed., by Janna (earlier editions are also fine). Some other **optional** textbooks include Design of Thermal Systems by Stoecker, and Thermal Design and Optimization by Bejan, Tsatsaronis & Moran. Additionally, you should have access to the texts used in your **Thermodynamics, Fluids, and Heat Transfer** courses. I will also post notes from various textbooks/sources on the web page and I have put a few textbooks (including the ones listed above) on reserve in the library.
- Requirement:** By 8/29, you are required to turn in one blank USB memory stick with a capacity of at least 512 MB. These memory sticks will be returned to you at the end of the semester (write your name on it if you want your specific one back). If you want to go in on these with your classmates, Amazon sells packs of 10 for ~\$25, fyi.
- Grading:**
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| Analysis Project Report (9/28) - 15% | Two Exams (10/12? & 11/21? ¹) - 15% each |
| Design Project Report (11/28 ²) - 30% | Subject Presentation 1 (9/26+) - 5% |
| DP Presentation (11/28, 30) - 5% | Subject Presentation 2 (11/7+) - 5% |
| | Homework - 10 % |
- For all graded assignments, clarity in logic and in presentation is crucial.
- DP:** The cornerstones of this class are a group analysis project and group design project (DP). Groups should be 5 students, and the same group will complete both projects. Teams must submit their members by the end of class on Aug. 31.
- SPs:** In addition to design project groups, groups of two students will do two short subject presentations (SPs; 3-5 minutes, **max**) during the class. The first subject presentation will focus on pipes, pumps, or energy conversion technologies, and the second subject presentation will focus on heat exchangers, economics, broader concerns, and additional advanced energy systems. Examples of these topics will be posted on the web. Pairs must submit their members by the end of class on Aug. 31.
- Homework:** Late homework will not be accepted. Homework is due at the beginning of class (with a 10 minute tardy window). Not necessarily every HW problem will be graded.

¹ We will discuss the timing of this exam in the second half of the semester.

² Notice that Thanksgiving is on 11/23 – this deadline is the first class after returning from break. Think about this when you draw up your team's work schedule for the semester!

Attendance: There is no explicit numerical penalty for missing class. However, in previous iterations of this course, I have observed a strong correlation between attendance and homework grades (and the resulting performance on exams). Moreover, group participation will be a factor in your final grade on the design project.

Honor Code: Exams require the honor code statement and signature. Homework should be your own work, but studying and discussing the problems with others is permissible. Project work should be the group's effort. It is acceptable to discuss your project with others, but the work submitted must be that of only your group.

ADA Notice: If you have a documented disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with Disability Support Services (Allen Center, Room 111 / adarice@rice.edu / x5841) to determine the accommodations you need; and 2) talk with me to discuss your accommodation needs.

Course Topics:

1. Introduction, Review of the Basic Equations, Energy Overview (Course Policy, Simulation, etc.)
2. Piping Systems (Flow Calcs and Networks)
3. Pumps (Types and Performance Evaluation)
4. Heat Exchangers (Evaluation and Physical Design Specifications)
5. Economics (Present/Future Worth, Investments)
6. Other Considerations (LCA, Ethics, etc.)
7. Other Topics: Fuel Cells, Optimization, Thermoeconomics, etc., as time permits

The above topics are subject to change based on the pace of the class and class dynamics.